Cnpt 8 Hw p 254 Q 5
264 Q 2,4
267 Q 2,3
269 Q 1
270 Q 20,21,24
271 Q 30,35
272 Q 37 a & b.

yay chemistry!

02-13-06

"Cnpt 8 Test starts here!"

Chpt 8: Chemical Equations (eqns) & Reactions (rxns)

reactions. Al (s) + $CuCl_2$ (aq) ⟶ Cu (s) + $AlCl_3$ (aq)

* • all obey LCM (matter can not be made nor destroy by ordinary means)

- to balance equation above ⟶ 2 Al (s) + 3 $CuCl_2$ (aq) ⟶ 3 Cu (s) + 2 $AlCl_3$ (aq)

reactants (starting materials) — "yields" sign — products (resulting materials)

called as formula equations (shows reactants & products as formulas)

word equation
- aluminum reacts with copper (II) chloride yielding copper metal & aluminum chloride.
↳ shows reactants & products as words.

* ions → to the max!

• ways to interpret formulas...

ex 2 Al (s) + 3 $CuCl_2$ (aq) ⟶ 3 Cu (s) + 2 $AlCl_3$ (aq)

→ coefficients tell us → 2 atoms Al + 3 of $CuCl_2$ → 3 atoms Cu + 2 of $AlCl_3$

→ too small! ... easier to work in moles

→ moles → 2 moles Al + 3 mol $CuCl_2$ ⟶ 3 mol Cu + 2 mol $AlCl_3$ [basis for chpt 9]

Symbols for equations

- (s) - solid
- (l) - liquid
- (g) - gas
- (aq) - aqueous (water based / dissolved in H_2O)
- (ppt), ↓ - precipitate [strictly on product side]
- ↑ - gas is being released

Chem. reaction is taking place if ... 1) color change (not explicit) 2) E is being changed 3) ppt. formed 4) a gas is released.

• Diff. yield signs

⟶ yield

$\xrightarrow{\Delta}$ heat added

$\xrightarrow[MnO_2]{Pt}$ } a catalyst is used

Rules for Balancing

* can NOT change subscripts when they have been set

1) (only applies to word equations) make sure all formulas are correct & all diatomic elements [if ALONE] are made diatomic.

ex chlorine → Cl_2 vs ex. potassium chloride → KCl.

2) Balance everything except H & O w/ coefficients

- treat polyatomics as 1 thing

3) Balance H

4) Balance O

5) Check work!

02-13-06 ~~zinc~~ zinc, not ion!

Chpt 8 cont.

Ex. ~~Zinc~~ plus hydrochloric acid yields zinc chloride + hydrogen gas.

(metal + acid → salt + hydrogen gas!)

1) $Zn + HCl \longrightarrow ZnCl_2 + H_2\uparrow$ **

2) $Zn + 2HCl \longrightarrow ZnCl_2 + H_2\uparrow$ --> balanced! ☺

Ex 2. 1) $Fe + O_2 \longrightarrow Fe_2O_3$

2) $2Fe + 3O_2 \longrightarrow 2Fe_2O_3$ --> iron not balanced

3) $4Fe + 3O_2 \longrightarrow 2Fe_2O_3$ --> balanced! ☺

Ex 3. 1) $Al(NO_3)_3 + Na_2CO_3 \longrightarrow Al_2(CO_3)_2 + NaNO_3$

2) $2Al(NO_3)_3 + 3Na_2CO_3 \longrightarrow Al_2(CO_3)_3 + 6NaNO_3$

Ex 4 1) $CH_4 + O_2 \longrightarrow CO_2 + H_2O$

2) $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$ ← combustion reactions

Ex 5 1) $C_4H_{10} + O_2 \longrightarrow CO_2 + H_2O$

2) $C_4H_{10} + 6.5\,O_2 \longrightarrow 4CO_2 + 5H_2O$ --> double every #!

3) $2C_4H_{10} + 13O_2 \longrightarrow 8CO_2 + 10H_2O$

02-14-06

Types of Reactions

- Synthesis Rxn: $A + X \rightarrow AX$ * ions !!
  - two elements --> $2H_2 + O_2 \rightarrow 2H_2O$
    --> $2Mg + O_2 \rightarrow 2MgO$
  - metal oxide & H_2O (will make hydroxides)
    --> $MgO + H_2O \longrightarrow Mg(OH)_2$
  - nonmetal oxide & H_2O (make acid)
    --> $CO_2 + H_2O \longrightarrow H_2CO_3$

02-27-06

Types of Reactions

- Synthesis : $A + X \rightarrow AX$ *ions!

ex (w/ 2 elements) : $Na + F_2 \rightarrow NaF$

$(Na^+) + (F^-)$

* then balance out equal --> $2Na + F_2 \rightarrow 2NaF$

ex (w/ metal & oxide) : $Na_2O + H_2O \rightarrow NaOH$

--> (balanced) : $Na_2O + H_2O \rightarrow 2NaOH$

ex (w/ nonmetal & oxide) : $CO_2 + H_2O \rightarrow H_2CO_3$

trioxide + water makes sulfuric acid: $SO_3 + H_2O \rightarrow H_2SO_4$

dioxide makes sulfurous acid: $SO_2 + H_2O \rightarrow H_2SO_3$

- decomposition : $AX \rightarrow A + X$

ex (w/ 2 elements) : $NaCl \rightarrow Na + Cl_2$

--> balance : $2NaCl \rightarrow 2Na + Cl_2$

↳ breaks down to form respective elements.

ex (w/ 3 elements) : $CuCO_3 \rightarrow CO_2\uparrow + CuO$ (II) (II)

always carbonate $\xrightarrow{\Delta}$ $CO_2\uparrow$ + metal oxide

ex (w/ hydroxide) : $Ca(OH)_2 \rightarrow H_2O\uparrow + CaO$

↳ water + metal oxide

ex (w/ metal chlorate) : $2KClO_3 \rightarrow 3O_2\uparrow + 2KCl$

↳ oxygen gas + metal chloride

- Single replacement : $A + BX \rightarrow AX + B$ --> like replaces like

ex (active metal replacing a less active metal) : $2Na + FeCl_2 \rightarrow 2NaCl + Fe$

- in lab : $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$.

ex (active metal + acid) : $Zn + HCl \rightarrow H_2\uparrow + ZnCl_2$ (ionic)

↳ always will produce $H_2\uparrow$ & a metal salt (any1 compond ... basically)

ex (very reactive metal w/ H_2O) : $2Li + 2H_2O \rightarrow H_2\uparrow + 2LiOH$ (HOH)

↳ $H_2\uparrow$ + hydroxide

* like replaces like *

AKA precipitate reactions

ex (active halogen replacing a unactive halogen) : $Cl_2 + 2NaBr \rightarrow 2NaCl + Br_2$

- Double Replacement Reactions : $AX + BY \rightarrow AY + BX$

- in lab : $3Zn(C_2H_3O_2)_2 + 2Na_3PO_4 \rightarrow 6NaC_2H_3O_2 + Zn_3(PO_4)_2\downarrow$

→ to produced ... they will break down

- $H_2SO_3 \rightarrow SO_2 + H_2O$
- $H_2CO_3 \rightarrow CO_2 + H_2O$
- $NH_4OH \rightarrow NH_3 + H_2O$

ex (neutralization reaction [acid + base]) : $HCl + NaOH \rightarrow H_2O + NaCl$

↳ water + salt

~~•~~ (combustion reactions) → hydrocarbon compt. + $O_2 \rightarrow CO_2 + H_2O$

03-01-06

Single Replacement Reactions: do they occur?

* use activity series. [on types of reaction handout sheet]

- higher up ⟹ the more reactive

[active metal replaces the less active metal]

Ex: $Na + AgCl \rightarrow NaCl + Ag$ [reaction can not be reversed]

(Na: active metal; AgCl: less active metal)

Ex: $Na + LiCl \rightarrow$ no reaction! b/c Na is less reactive than Lithium.

- Active metal replaces H in acids

Ex: $2HCl + Zn \rightarrow ZnCl_2 + H_2$

- Active metal reacts w/ H_2O

Ex: $Zn + H_2O(g) \rightarrow Zn(OH)_2 + H_2\uparrow$

$Zn + H_2O$ (liquid) → No reaction!

Halogen-halogen Single Replacements.

- more reactive halogen replaces less active halogen.

Ex: $2NaCl + F_2 \rightarrow 2NaF + Cl_2$

Ex: $Br_2 + NaCl \rightarrow$ no reaction!

Double Replacement Reaction: do they occur?

also called ppt reactions --> a ppt is formed

- involving two aqueous solutions

Ex: $NaCl(aq) + AgNO_3(aq) \rightarrow NaNO_3(aq) + AgCl(ppt)$ (↓)

* cruncher sheet: (back of 2nd pg) --> solubility (Δ) table

03-02-06

- $AgNO_3(aq) + Na_2SO_4(aq) \rightarrow Ag_2SO_4(aq) + 2NaNO_3(aq)$

  [I will NOT happen] → no ppt!

  → no reaction b/c products are soluble.

✳ • When ionic compounds dissolve, they dissociate [break apart] into their respective ions.

- $Ag^+ \quad NO_3^- + 2Na^+ + SO_4^{2-}$ → no combo of ions that will form a ppt.

- $3AgNO_3(aq) + Na_3PO_4(aq) \rightarrow Ag_3PO_4(ppt) + 3NaNO_3(aq)$

  $3Ag + (3NO_3^-) + (3Na^+) + PO_4^{3-} \rightarrow 3Ag^+ + PO_4^{3-} + (3Na^+) + (3NO_3^-)$

  Ag_3PO_4 ↓

  R

  • an Ionic Eqn. shows all reactants & products as ions.

  ◯ → spectator ions.

  • If spectator ions are cancelled → Net ionic equation

  • ex $3Ag^+ + PO_4^{3-} \rightarrow Ag_3PO_4$ ↓